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AID Report 62-27 28 February 1962

ITEM OF INTEREST

Prepared by

Aerospace Information Division

SUBJECT: Temperature of Venus

SOURCE: Kuz'min, A. D., and A. Ye. Salomonovich. Results of observations of radio emission from Venus during 1961. Astronomicheskiy zhurnal, v. 38, no. 6, Nov-Dec 1961, 1115-1117. QB1.A47, v. 38. (S/033/61/038/006)

Radio emission from Venus was measured with the 22-m radio telescope of the Physics Institute imeni P. N. Lebedev during the period of inferior conjunction in 1961. From the middle of March to the beginning of June, observations were made at wavelengths of 4 and 8 mm and 9.6 cm and from 26 May through 10 July, at the 3.3- cm wavelength.

Observational data obtained at wavelengths of 4 and 8 mm and 3.3 cm show a regular increase of the brightness temperature with a relative increase of the illuminated part of the disk. The minimal values of brightness temperature found at wavelengths of 4 and 8 mm were 390° ± 120°K and 374° ± 75°K, respectively. Both minima appeared before true inferior conjunction. Brightness temperature observations of the illuminated part from 0.33 to 0.6 of the disk show values ranging from 500 to 600°K. Linear extrapolation of the temperature for a totally dark disk at true inferior conjunction yielded 372° ± 55°K.

As revealed at the 4- and 8-mm wavelengths, the brightness temperature of the unilluminated side is approximately 370°K. Relating this temperature to thermal emission from the planetary surface and lower atmospheric layers, one obtains an approximate average value of 400°K. Extrapolation of the observational data to the totally illuminated disk yields a value of 750°K. The authors assume that this value includes sporadic ionospheric emission, which on the day side of the planet has a high electron concentration. They hold further that in determining the brightness temperature at wavelengths of 4 and 8 mm and 3.3 cm, water vapor and high pressures in the Venusian atmosphere are not as significant as Barrett had hypothesized. [See: Astrophysical journal, v. 133, no. 1, 1961, 281.]

The shifting of the brightness-temperature minimum from the point of inferior conjunction to the eastern elongation indicates that the rotation of Venus occurs in the same direction as its revolution around the sun. The shifting is also considered to support the hypothesis that the rotation period is not equal to the revolution period. The wide variations in temperature may be attributed to changes in electron accumulations in the Venusian ionosphere.

COMMENT:

The temperature of the Venusian surface and atmospheric layers and the rotation period of the planet have been the objects of many inconclusive investigations. Radioastronomy presents a new approach to the question. The observational data obtained by Kuz'min and Salomonovich agree with that obtained at the United States Naval Research Laboratory. The brightness temperature is seen to increase with the increase of wavelength used. Though the Soviet investigations have not yet been developed to the extent that a definite law of change might be stated, they do indicate a trend in this direction and appear to be of definite interest. The authors' conclusions in regard to the shifting of the minimum to the eastern elongation, indicating different lengths of rotation and revolution periods, appear to be well substantiated. [See also: AID Report 61-30.]